

# P3 to Switchyard/Meson optics study

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# The Study

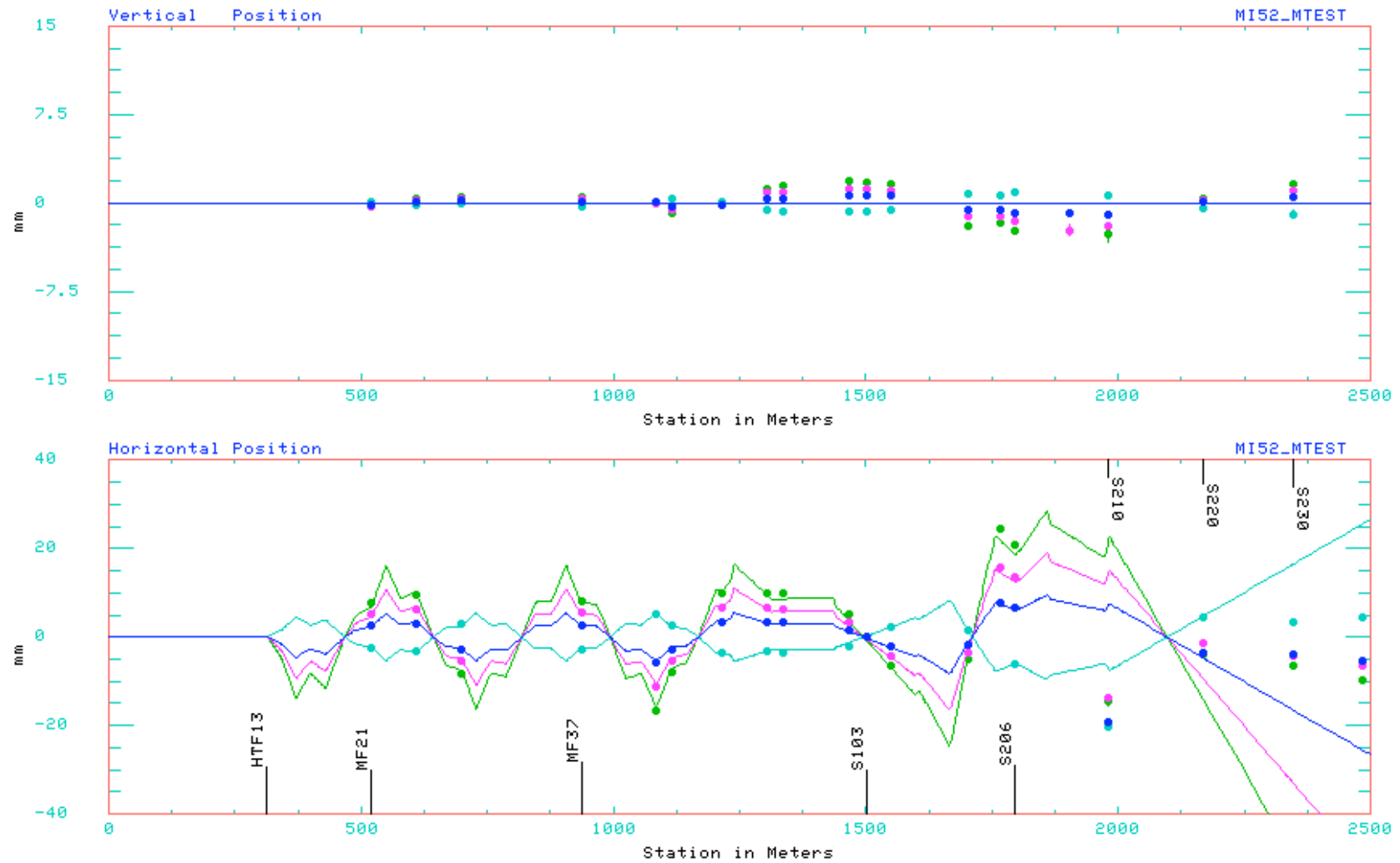
## ◆ Data

- \* Slow extracted beam
  - Profile data only.
- \* Single turn extracted beam
  - I-bump orbit with HTF13, HTF15, VTF14, and VTF16.
  - Varied the MI 120 GeV flat-top frequency.
  - I90 program takes data up to Multi-wire MWCI.
  - Profile data.

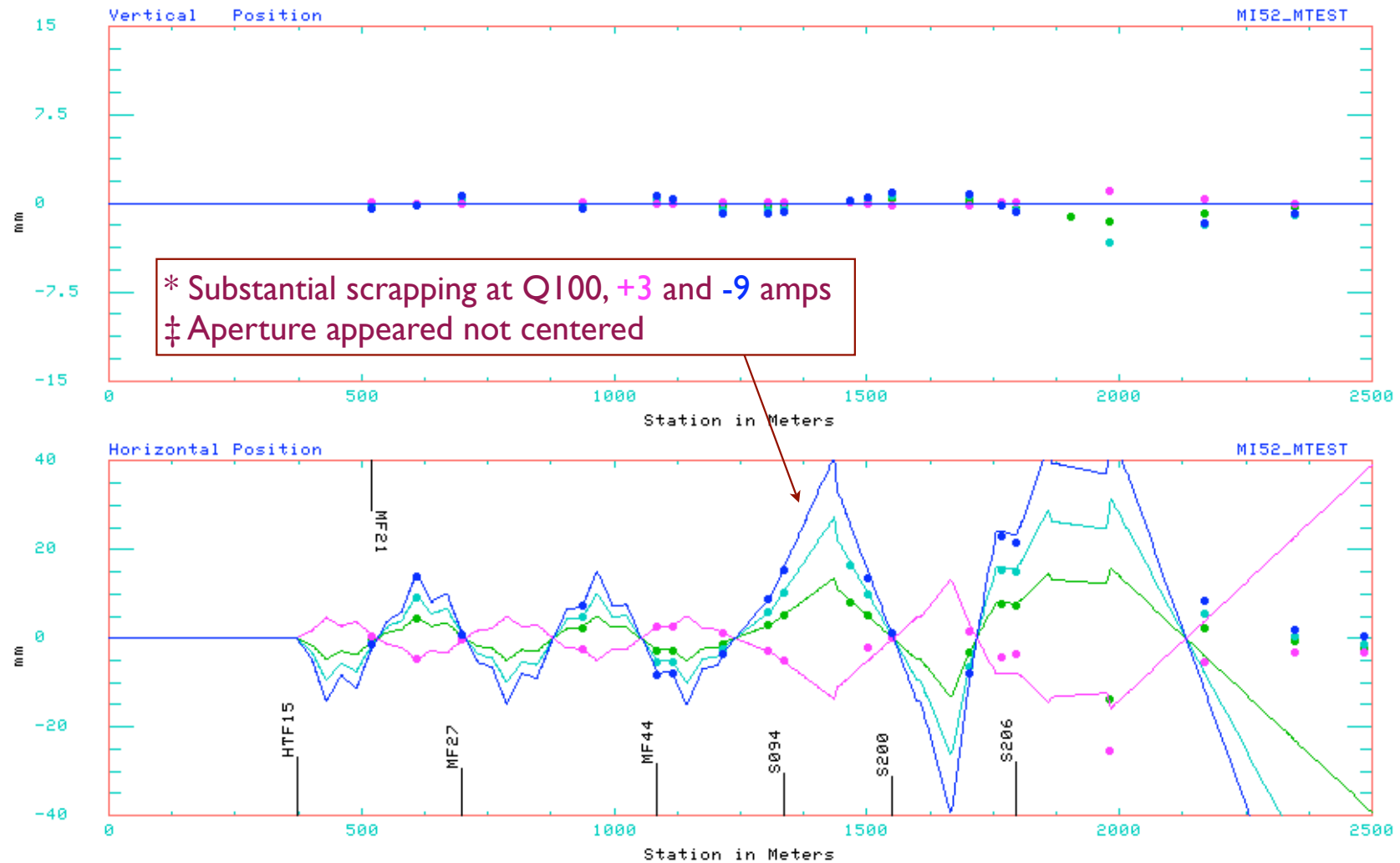
## ◆ Analysis

- \* Verify beamline optics orbits from I-bump orbit.
- \* Verify dispersion function.
- \* Compare beam width sigma for
  - Single turn extraction.
  - Slow extraction.

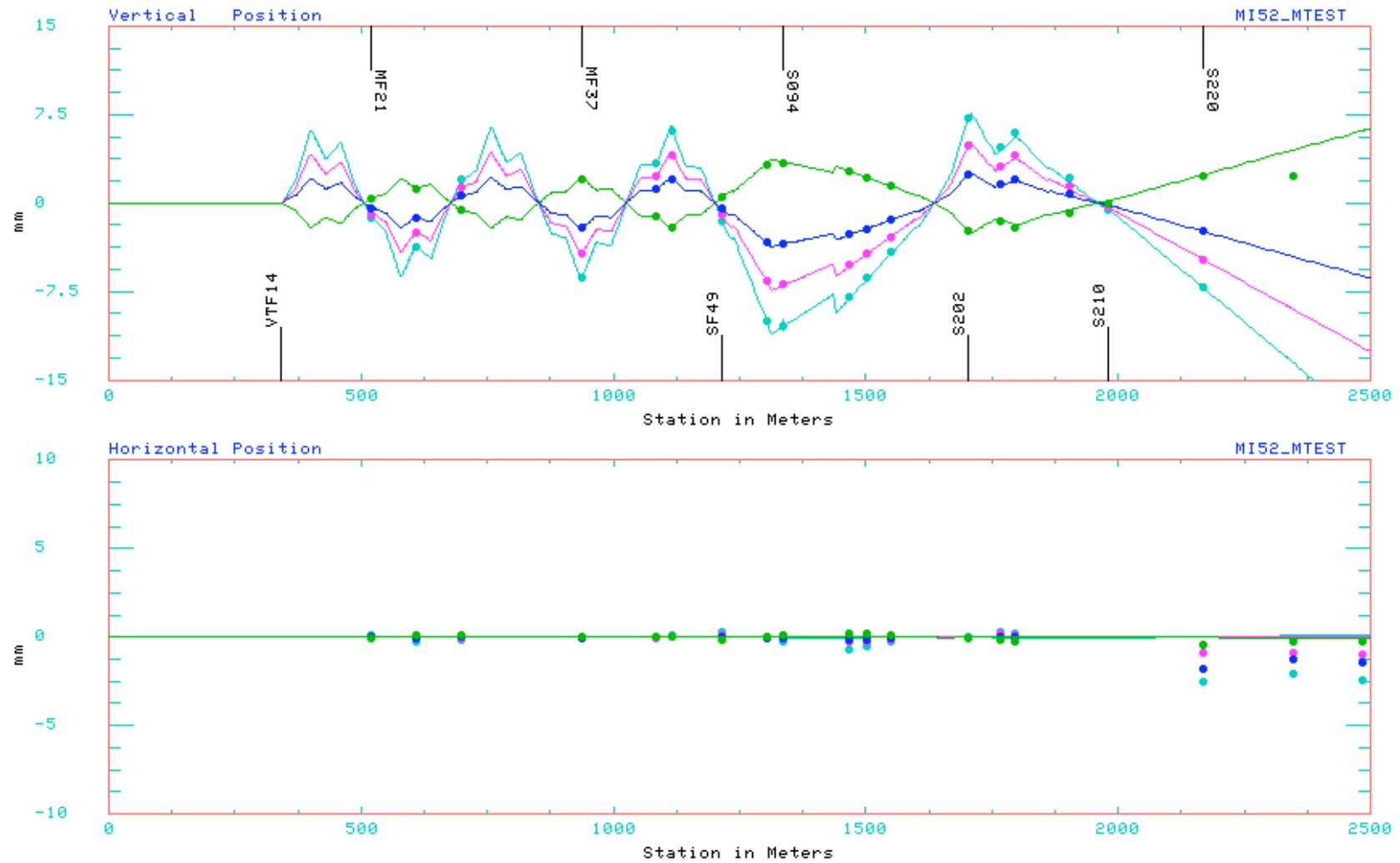
# Orbit due to HTF13



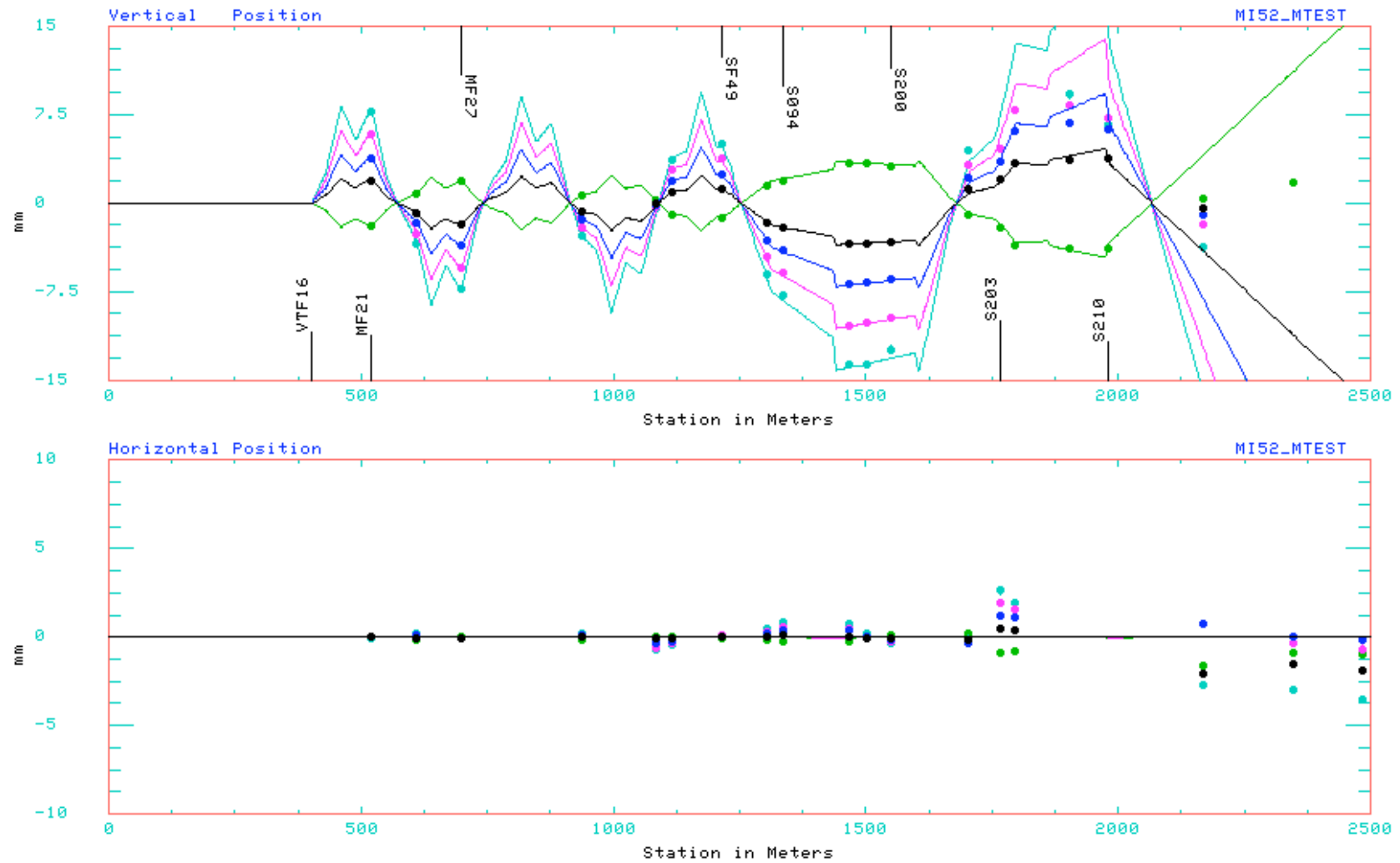
# Orbit due to HTF15



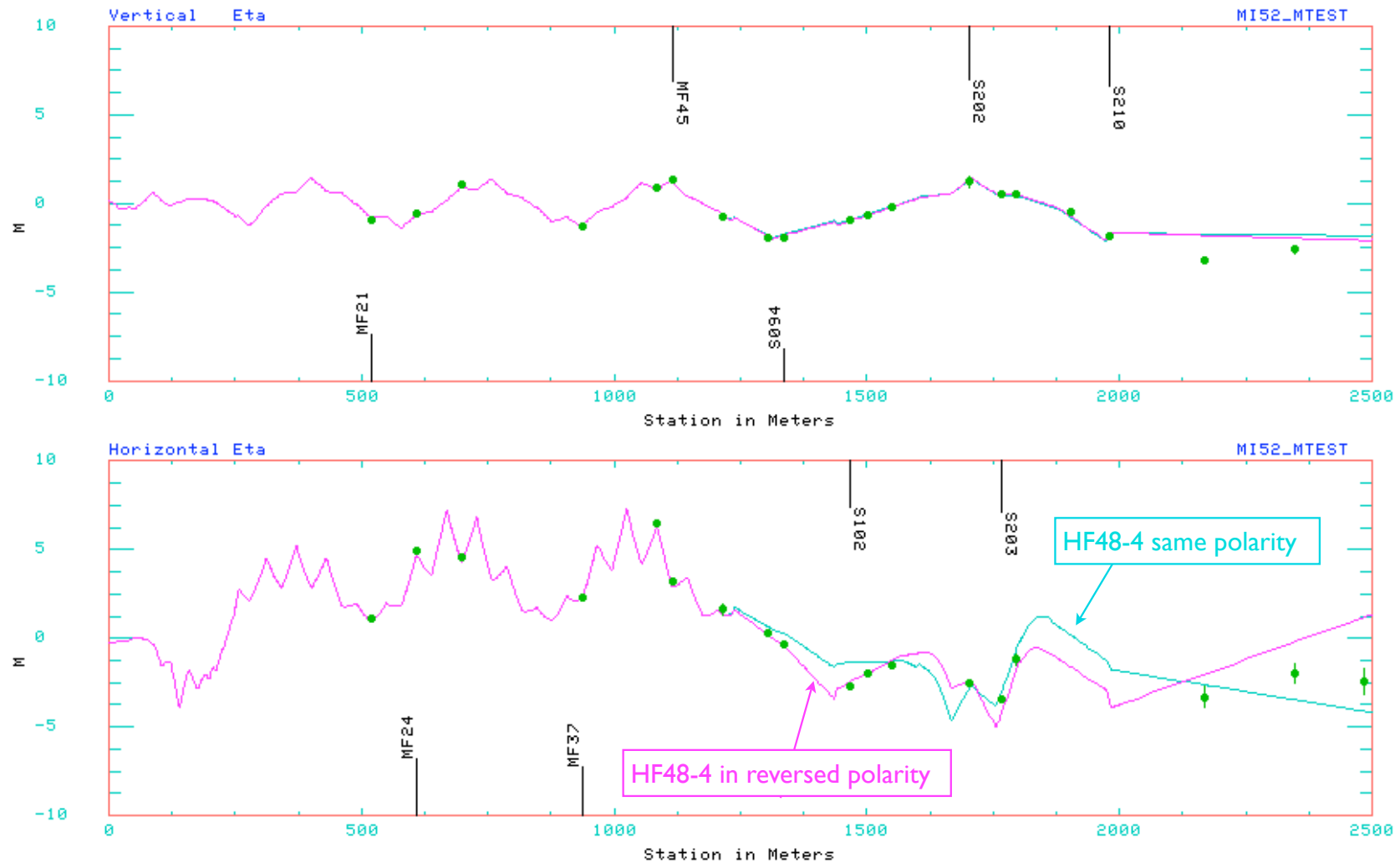
# Orbit due to VTF14



# Orbit due to VTF16

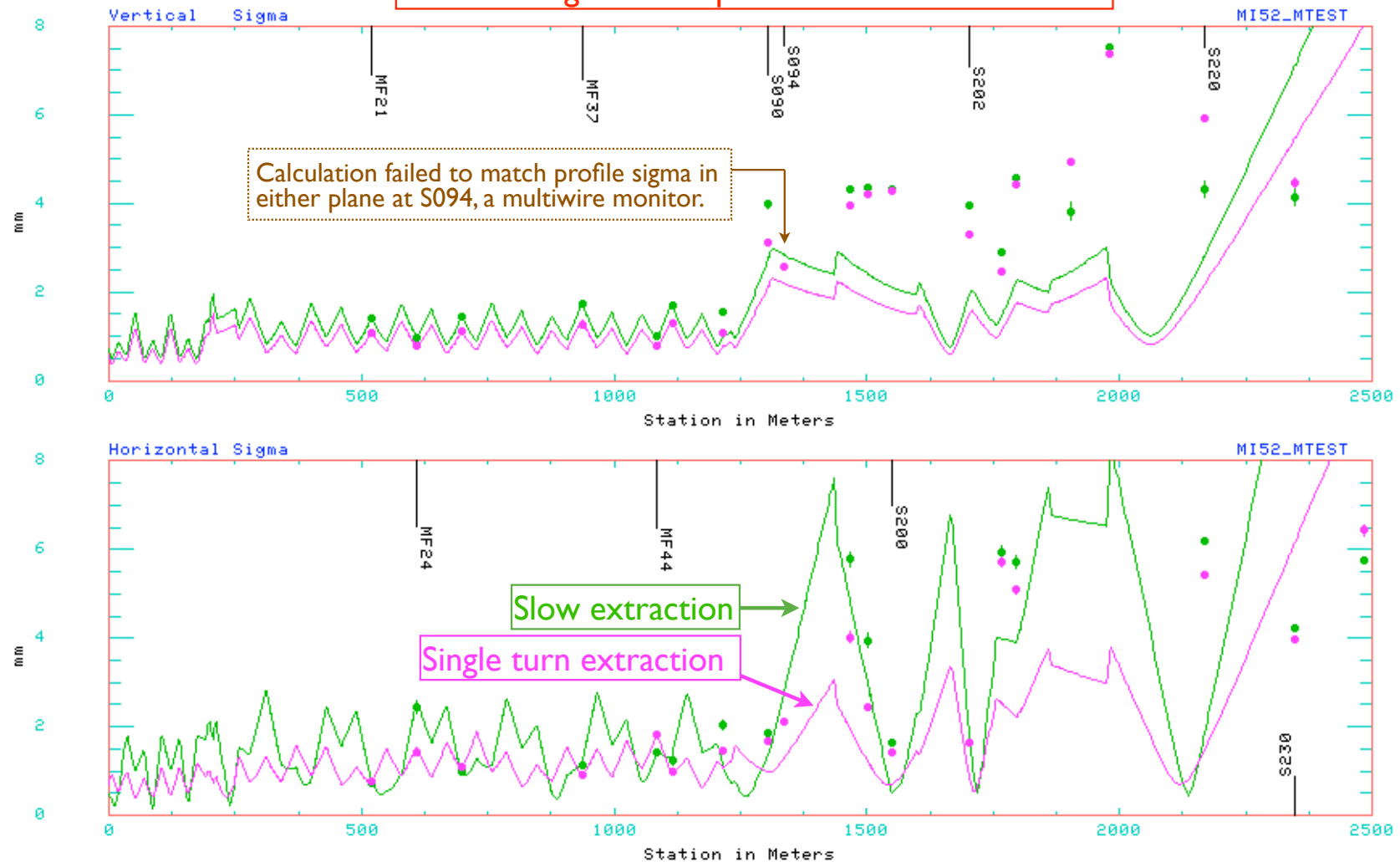


# Dispersion function



# Fitting profile sigma

Use MW sigma data up to MF45 to fit emittances





# Initial lattice & fitted emittances

## Single turn extraction

```

Lattice parameters
Select: [MI52_MTEST ] as [Transfer line]
Start at element: [P150_START] for [Proton ]
*Track: [Lattice function] at ( 120 ) GeV

Lattice      Horz      Vert
Phase: ( 6.17636 ) ( 5.68791 ) 2 $\pi$ 
Beta: ( 32.96 ) ( 21.99 ) M
Alpha: ( -1.9344 ) ( 1.573 )
eta: ( -.22 ) ( .14 ) M
etap: ( -.016 ) ( -.01 )

Beam
Position: ( 0 ) ( 0 ) mm
Angle: ( 0 ) ( 0 ) mrad
Emittance: ( 1.92604 ) ( 1.82833 )  $\pi$ -mm-mrad
            $\pm$  .180952  $\pm$  .135137
SigmaP/P: ( .17165 )  $\pm$  .01666 E-3
DeltaP/P: ( 0 ) E-3

*Fit emittance: [None ]
Momentum sigma from [Horizontal] plane

*Update [reference orbit]
Graphic window link: [GxPA 2]
*Set lattice to [Linear] order and with [Matrix]

<Exit>

```

## Slow extraction

```

Lattice parameters
Select: [MI52_MTEST ] as [Transfer line]
Start at element: [P150_START] for [Proton ]
*Track: [Lattice function] at ( 120 ) GeV

Lattice      Horz      Vert
Phase: ( 6.41592 ) ( 5.68791 ) 2 $\pi$ 
Beta: ( 19.96 ) ( 21.99 ) M
Alpha: ( .844 ) ( 1.573 )
eta: ( -.22 ) ( .14 ) M
etap: ( -.016 ) ( -.01 )

Beam
Position: ( 0 ) ( 0 ) mm
Angle: ( 0 ) ( 0 ) mrad
Emittance: ( 1.4245 ) ( 3.10138 )  $\pi$ -mm-mrad
            $\pm$  .062856  $\pm$  .152697
SigmaP/P: ( .16494 )  $\pm$  .00917 E-3
DeltaP/P: ( 0 ) E-3

*Fit emittance: [Emitt & sig_p/p]
Momentum sigma from [Horizontal] plane

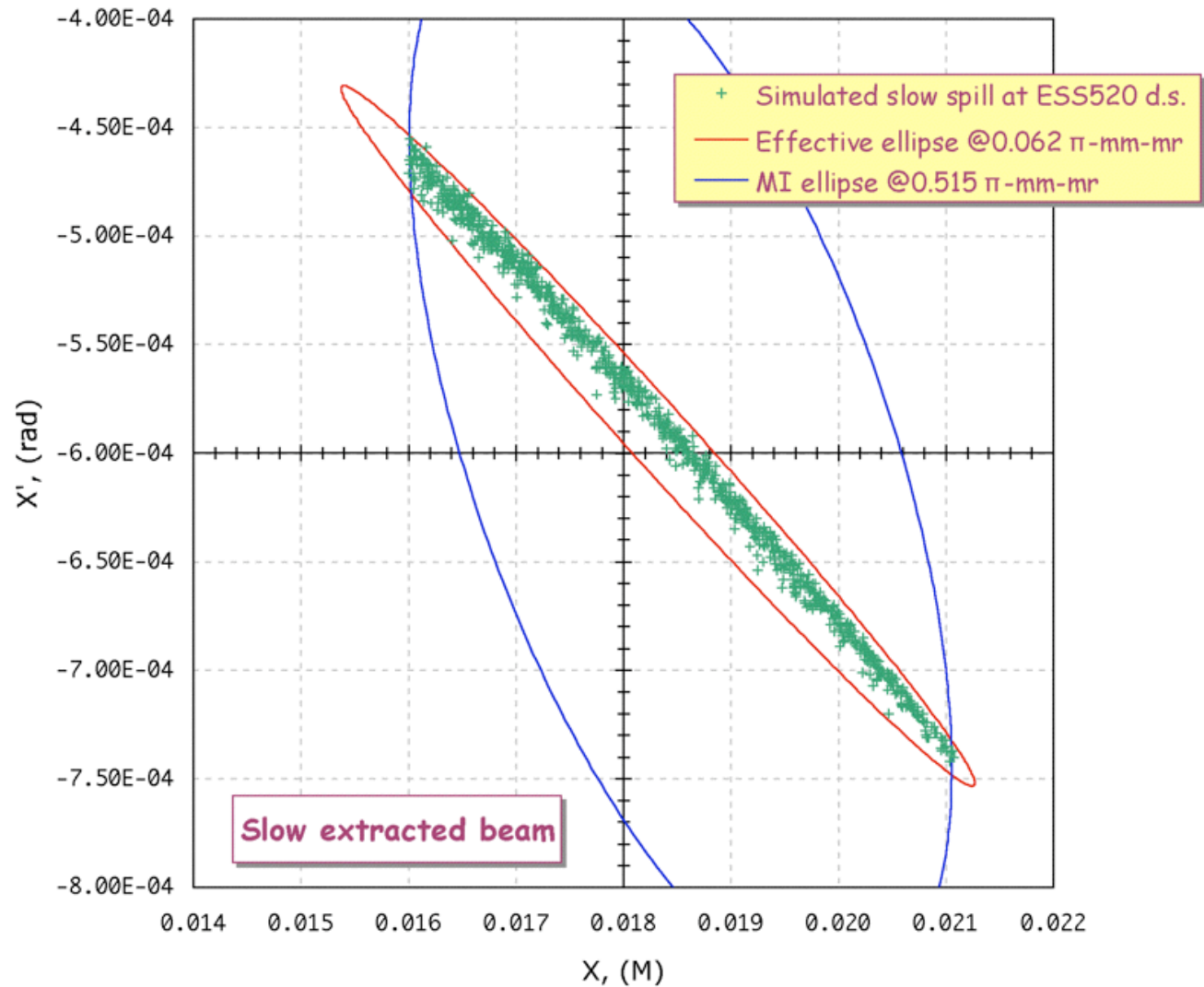
*Update [reference orbit]
Graphic window link: [None ]
*Set lattice to [Linear] order and with [Matrix]

<Exit>

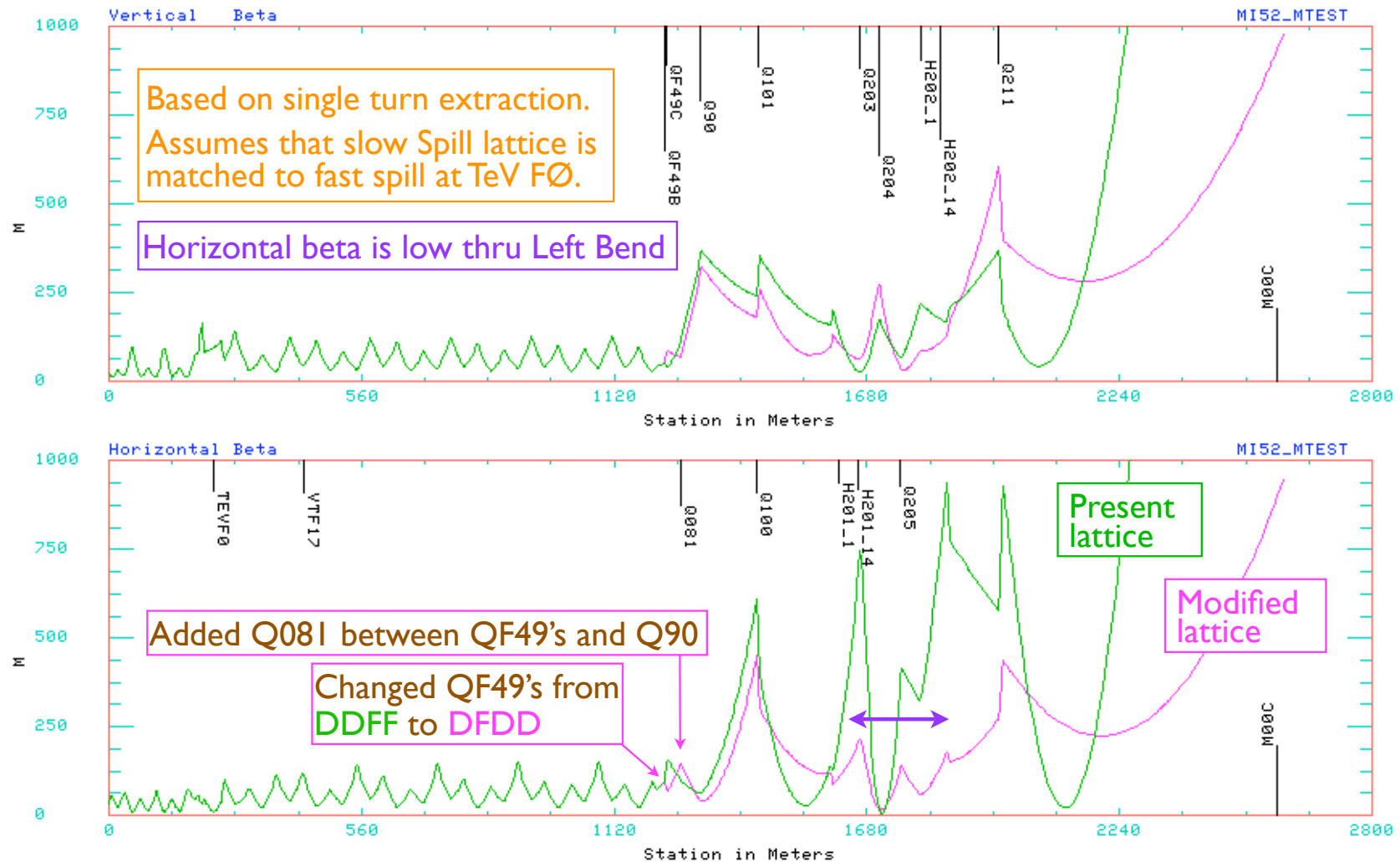
```

# Simulation of slow extraction

(J. Johnston/D. E. Johnson)



# Example of modified SY120 lattice



# Found Problems in profile monitors

## ◆ SF49

- ▶ Horizontal plane is reversed.

## ◆ S094

- ▶ 0.5 mm pitch in the vertical plane.
- ▶ Many dead wires.

## ◆ S202

- ▶ Vertical plane is reversed.

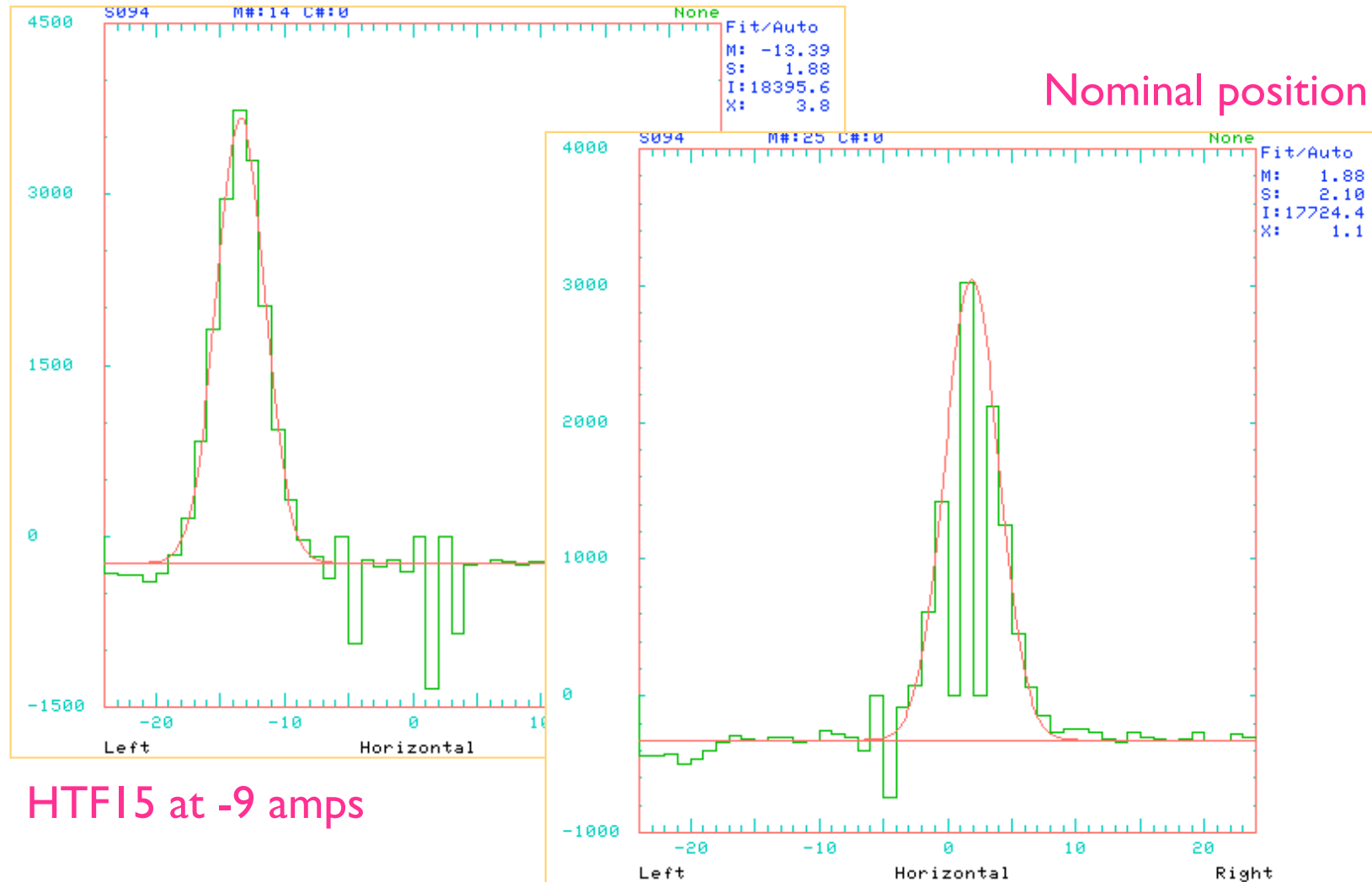
## ◆ S206

- ▶ Horizontal plane is reversed.

## ◆ S208

- ▶ Signal is poor.

# Missing wires in S094 Horizontal plane



# Dispersion function

- ◆ Vertical plane
  - \* Matched up to S210.
- ◆ Horizontal plane
  - \* Matched well up to F49 location
  - \* H48-4
    - ▶ 10-ft regular strength B2.
    - ▶ Not known to be of opposite polarity.
  - \* Other possible sources of discrepancy
    - ▶ Continue to look into the calculation setup.
    - ▶ Visit the tunnel when possible.

# Summary of study results

## ◆ Orbit Data

- \* Matched up to S206 in horizontal and S210 in vertical plane.

## ◆ Dispersion data

- \* Good match up to F49 horizontally and S210 vertically.
- \* F49 to Meson horizontal
  - ▶ Need to understand the source of discrepancy.

## ◆ Fitting sigma for lattice function

- \* Single turn extraction.
- \* Slow extraction
- \* All profiles after MF45 were ignored.

## ◆ Re-do lattice function

- \* Match slow spill to single turn extraction before TeV F0.
- \* Minimize over-all beta function from p3 to Meson.
- \* Finalize change with MAD calculation.